IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Paul R. Sharps et al.	Art Unit	: 1753
Serial No.	: 10/723,456	Examiner	: Anthony D. Fick
Filed	: November 26, 2003	Conf. No.	: 5958
Title	: MULTIJUNCTION SOLAR CELL WITH A BYPASS DIODE		

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
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BRIEF ON APPEAL

(1) Real Party in Interest

The real party in interest is Emcore Corporation, the assignee of the pending application.

(2) Related Appeals and Interferences

The present application is a continuation of U.S. Application No. 09/999,598.

An appeal to the Board of Appeals has been filed in connection with U.S. Application No. 10/773,343, which is a continuation of U.S. Application No. 10/280,593, which, in turn, is a continuation-in-part of U.S. Application No. 09/999,598.

(3) Status of Claims

Claims 1-47, 67 and 81 have been canceled.

Claims 48-66, 68-80 and 82-98 stand rejected and are the subject of this appeal.

(4) Status of Amendments

An Amendment canceling dependent claim 67 is submitted concurrently with this Appeal Brief.

(5) Summary of Claimed Subject Matter

When solar cells in an array are receiving sunlight or are illuminated, the cells may be forward biased. If some cells in the array are not illuminated, those cells may be forced to become reverse biased in order to carry current generated by other illuminated cells. This reverse biasing can degrade the non-illuminated cells and ultimately render them inoperable. In order to prevent damage to the non-illuminated cells, a diode structure can be implemented in an alternate parallel path that draws away current and maintains a connection to the next cell.

The present application discloses, among other things, fabrication processes in which the semiconductor layers for the bypass diode are from the same layers that form part of the solar cell (*see, e.g.*, FIG. 5 and par. [0036]). Thus, the present application discloses integrated structures in which the semiconductor layers in different parts of the structure have substantially the same composition and thickness.

Claims 48 and 52

Independent claims 48 and 52 recite integrated semiconductor structures that include a multijunction solar cell and means for passing current when the multjunction solar cell is shaded. The multijunction solar cell includes a bottom subcell.

An example of such a structure is illustrated in FIG. 1, where the multijunction solar cell is identified by reference numeral 100, the bottom subcell is identified by reference numeral 103, and the means for passing current includes a bypass diode 106.

According to claims 48 and 52, the means for passing current and the bottom subcell have an identical sequence of semiconductor layers. Each semiconductor layer in the means for passing current has substantially the same composition and thickness as the corresponding layer in the bottom subcell. (*See, e.g.*, the semiconductor layers in sections 103 and 106 of FIG. 1; *see also* FIG. 5 and par. [0036])

Claim 57

Independent claim 57 recites an integrated semiconductor structure that includes a multijunction solar cell with a first solar, and a bypass diode.

An example of such an structure is illustrated in FIG. 1, where the multijunction solar cell with the first solar cell is identified by reference numeral 100, and the bypass diode is identified by reference numeral 106.

According to claim 57, the bypass diode and the first solar cell have an identical sequence of semiconductor layers. Each semiconductor layer in the bypass diode has substantially the same composition and thickness as the corresponding layer in the first solar cell. (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

Claim 60

Independent claim 60 recites an integrated semiconductor structure that includes a multijunction solar cell and means for passing current when the multjunction solar cell is shaded. The multijunction solar cell includes first and second solar cells.

An example of such a multijunction solar cell is illustrated in FIG. 1 and identified by reference numeral 100. In the illustrated example, the means for passing current includes a bypass diode 106.

According to claim 60, the means for passing current and the first solar cell have an identical sequence of semiconductor layers. Each semiconductor layer in the means for passing current has substantially the same composition and thickness as the corresponding layer in the first solar cell. (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

Claim 65

Independent claim 65 recites a solar cell semiconductor device including an integral semiconductor body having a sequence of layers of semiconductor material including a first region in which the sequence of layers of semiconductor material forms the first cell of a multijunction solar cell. The solar cell semiconductor device also includes a second region laterally spaced apart from the first region and in which the sequence of layers corresponding to the sequence of layers forming the first cell forms a bypass diode. FIG. 1 illustrates an example of the first region (left-hand side) and the second region forming the bypass diode (right-hand side).

According to claim 65, the sequence of semiconductor layers in the first region forming the first cell and the sequence of semiconductor layers in the second region forming the bypass diode are identical. Each semiconductor layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region. (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

Claims 68 and 77

Independent claims 68 and 77 recite solar cell semiconductor devices that include a substrate and a sequence of layers of material deposited on the substrate. The sequence of layers of material includes a first region in which the sequence of layers of material forms at least one cell of a multijunction solar cell, and a second region in which the corresponding sequence of layers forms a bypass diode to protect the cell against reverse biasing.

An example of the solar cell semiconductor device is illustrated in FIG. 1 in which the substrate is identified by reference numeral 104. FIG. 1 illustrates an example of the first region forming a cell of a multijuncition solar cell (left-hand side) and the second region forming the bypass diode (right-hand side).

According to claims 68 and 77, the sequence of layers in the first region forming the at least one cell and the sequence of layers in the second region forming the bypass diode are identical. Each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

Claim 88

Independent claim 88 recites a solar cell semiconductor device that includes a substrate and a sequence of layers of semiconductor material deposited on the substrate. The device includes a first region in which the sequence of layers of semiconductor material forms at least one cell of a multijunction solar cell, and a second region in which the corresponding sequence of layers forms a bypass diode to protect said cell against reverse biasing.

An example of the solar cell semiconductor device is illustrated in FIG. 1 in which the substrate is identified by reference numeral 104. FIG. 1 illustrates an example of the first region

forming a cell of a multijuncition solar cell (left-hand side) and the second region forming the bypass diode (right-hand side).

According to claim 88, the sequence of layers in the first region forming the at least one cell and the sequence of layers in the second region forming the bypass diode are identical. Each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region. (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

Claim 93

Independent claim 93 recites a solar cell semiconductor device that includes a substrate and a sequence of layers of semiconductor material deposited on the substrate. The sequence of layers includes a first region in which the sequence of layers of semiconductor material forms at least one cell of a multijunction solar cell and a second region laterally spaced apart from the first region.

An example of the solar cell semiconductor device is illustrated in FIG. 1 in which the substrate is identified by reference numeral 104. FIG. 1 illustrates an example of the first region forming a cell of a multijuncition solar cell (left-hand side) and the second region forming the bypass diode (right-hand side).

According to claim 93, the sequence of layers in the second region and the sequence of layers in the first region are identical. Each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region. (*See, e.g.*, FIG. 1; *see also* FIG. 5 and par. [0036])

(6) Grounds of Rejection to be Reviewed on Appeal

(A) Whether claims 48-66, 68-80 and 82-98 are unpatentable under 35 U.S.C. § 112, first paragraph because of the language "substantially the same composition and thickness."

(B) Whether claims 48-66, 68-80 and 82-98 are unpatentable under 35 U.S.C. § 112, second paragraph because of the language "substantially the same composition and thickness."

(7) Argument

(A) The language "substantially the same composition and thickness" in claims 48-66, 68-80 and 82-98 does not render those claims <u>unpatentable under 35 U.S.C. § 112, First Paragraph</u>

The Office Action alleges that the pending claim fail to satisfy § 112, ¶ 1 because "the original specification does not contain support for the broadening language 'substantially the same composition and thickness.'" (Office Action, March 22, 2007, p. 6) Applicant respectfully submits that the Examiner has misinterpreted and misapplied the requirements of §112, ¶ 1.

Although, as disclosed in the specification, the deposited semiconductor layers can generally be characterized as having "the same" composition and thickness, a person of ordinary skill in the art would have understood that the deposition process of the type described in this Application inherently leaves small variations in the thickness and composition of the deposited layers, resulting in layers that are "substantially the same" in thickness and composition. Indeed, the Examiner himself recognizes that:

> [s]light variations in thickness and composition are inherent for any deposited film and one skilled in the art would recognize such variations upon reading the specification.

(Final Office action, March 22, 2007, p. 6, par. 6) Out of an abundance of caution and in the interest of technical accuracy, Applicant amended the claims to recite expressly a feature disclosed inherently in the specification

Nevertheless, the final Office action argues that the term 'substantially' "seems to be adding more variations than the typical variations present in layers of 'the same' composition

and thickness." (*Id.* at page 7) The Office action, however, provides no basis for such an assertion.

Furthermore, the Examiner fails to take account of the statements regarding the phrase "substantially the same" in Applicant's §1.132 Declaration. For example, as stated in Applicant's Declaration (page 3, pars. 7-8):

> 7. [ ] Therefore, inherent as a result of the manufacturing process is the fact that the layers of the bypass diode have substantially the same composition and thickness because the bypass device and the subcell were formed from the same layers before etching, and the thickness of the remaining layers is not changed by the etching.
>
> 8. Therefore, out of an abundance of caution and in the interest of technical accuracy, rather than using the absolute expression "the same" in the claims, the undersigned submits that the phrase "substantially the same" is more accurate and is supported by the specification as would be understood by those skilled in the art reading a description of the fabrication process described from page 5, line 27 through page 8, line 4 of the application as filed."

Where, as here, an applicant files a declaration explaining why those skilled in the art would find support in the specification for the claimed subject matter, the Examiner cannot dismiss the declaration without "articulating adequate reasons to rebut" the declaration. *In re Alton*, 76 F.3d 1168, 1176 (Fed. Cir. 1996); *see also* MPEP § 716.01(B) ("[T]he examiner must specifically explain why [the declaration] is insufficient. General statements . . . without an explanation supporting [his or her] findings are insufficient.").

The claims must be interpreted in a manner consistent with the specification and consistent with how a person of ordinary skill would understand them (*see* MPEP § 2111). Therefore, the phrase "substantially the same" should be interpreted in a manner consistent with what the Examiner agrees is disclosed in the specification as would be understood by one of ordinary skill in the art. The §1.132 Declaration supports the position that the phrase "substantially the same composition and thickness" is consistent with what the Examiner agrees is disclosed in the specification as would be understood by one of ordinary skill in the art.

Therefore, the phrase "substantially the same composition and thickness" is supported by the application as filed and is not beyond the scope of the original disclosure.

Nor, as alleged by the Final Office action (page 7, par. 6), is the addition of the term "substantially" in the claims "superfluous." Although the Examiner apparently agrees that the a person of ordinary skill, upon reading the specification, would recognize that slight variations in thickness and composition are inherent for the deposited films (*see* quote, *supra*), there is no clear indication that the phrase "*the same* composition and thickness" in the claims would literally cover such variations. Therefore, as explained above, out of an abundance of caution and in the interest of technical accuracy, applicant used the phrase "substantially the same." Applicant is entitled to claims that literally cover aspects of the invention disclosed in the specification.

In view of the foregoing remarks, the rejections of the claims — as allegedly failing to satisfy the requirements of section 112, first paragraph because of the language "substantially" the same composition and thickness — should be reversed.

(B) The Rejections of Claims 48-66, 68-80 and 82-98 under 35 U.S.C. § 112, Second Paragraph Should Be Reversed

The Office Action asserts that the phrase "substantially the same thickness and composition" is indefinite under § 112, ¶ 2 because there "is no basis in the specification as filed for interpretation" of the term 'substantially.'" (Final Office Action, March 22, 2007, pp. 7-8, par. 6) The Office Action also rejects the arguments raised by the Applicant because it "is not clear how close to having the same thickness the corresponding layers must have in order to be considered to have 'substantially the same thickness.'" (*Id.*) Applicant respectfully disagrees.

As noted above, the Examiner acknowledges that a person of ordinary skill would recognize, upon reading the specification, that "[s]light variations in the thickness and composition are inherent for any deposited film." (*Id.*, at p. 6, par. 6) As indicated in Applicant's §1.132 Declaration, the term "substantially the same thickness" corresponds to normal variations of up to two to three percent in composition and in thickness of a compound semiconductor layer over the surface of the wafer. (*See* Applicant's §1.132 Declaration, p. 2,

par. 5) Thus, contrary to the statements in the Final Action, the normal range of up to two to three percent variations makes clear "how close to having the same thickness the corresponding layer must be" and falls well within manufacturing specifications for actual commercial products.

Applicant acknowledges that the specification does not expressly disclose the range of up to two to three percent variations. However, that is not the relevant issue. Rather, the question is whether the phrase "substantially the same" serves reasonably to describe the subject matter of the claim so that its scope would be understood by a person of ordinary skill. In view of the Examiner's acknowledgement about what a person of ordinary skill would understand from the specification, and in view of the Applicant's §1.132 Declaration indicating what constitutes normal variations in composition and thickness, it is clear that the language "substantially the same composition and thickness" reasonably apprises one of the scope of the claims.

To the extent the Examiner's rejection is based on a perception that the term "substantially" bears some imprecision, Applicant respectfully submits that § 112, ¶ 2 does not impose such a high threshold for claim definiteness. "That some claim language may not be precise . . . does not automatically render a claim invalid." *Seattle Box Co. v. Industrial Crating & Packing*, 731 F.2d 818, 826 (Fed.Cir.1984). The MPEP instructs examiners in a similar vein:

> When the examiner is satisfied that patentable subject matter is disclosed, and it is apparent to the examiner that the claims are directed to such patentable subject matter, he or she should allow claims which define the patentable subject matter with a reasonable degree of particularity and distinctness. Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire.

MPEP § 2173.02. Although claims that are "insolubly ambiguous" or "not amendable to construction" are indefinite under § 112, ¶ 2, *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1347 (Fed. Cir. 2006), where, as here, "the term 'substantially' serves reasonably to describe the subject matter so that its scope would be understood by persons in the field of the invention, . . . it is not indefinite." *Verve, LLC v. Crane Cams, Inc.*, 311 F.3d at 1120.

Applicant's arguments are supported by the numerous Federal Circuit decisions approving the use of the term "substantially" under § 112, ¶ 2. *See, e.g., Verve*, 311 F.3d 1116, 1119-20 (Fed.Cir. 2002); *Ecolab Inc. v. Envirochem, Inc.*, 264 F.3d 1358, 1367 (Fed.Cir.2001); *Howmedica Osteonics Corp. v. Tranquil Prospects, Ltd.*, 401 F.3d 1367, 1373 (Fed. Cir. 2005); *LNP Engineering Plastics, Inc. v. Miller Waste Mills, Inc.*, 275 F.3d 1347, 1356 (Fed. Cir. 2001); *Andrew Corp. v. Gabriel Electronics, Inc.*, 847 F.2d 819, 821 (Fed. Cir. 1988); *Seattle Box Co., Inc.*, 731 F.2d at 826; *Kinzenbaw v. Case LLC*, 179 Fed.Appx. 20, 30 (Fed. Cir. 2006); *see also* MPEP 2173.05(b).[1] The Federal Circuit also has upheld the definiteness of claim terms that closely resemble "substantially the same," including "substantially equal," "substantially equal to" and "substantially uniform." *See Andrew Corp.*, 847 F.2d at 821 ("substantially equal"); *Seattle Box Co., Inc.*, 731 F.2d at 826 ("substantially equal to"); *Ecolab Inc.*, 264 F.3d at 1367 ("substantially uniform").

For the foregoing reasons, Applicant respectfully requests reversal of the rejections under § 112, ¶ 2.

(8) <u>Summary</u>

Applicant requests that all rejections of claims 48-66, 68-80 and 82-98 be reversed and that the claims be allowed.

The fee for the appeal brief is being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other charges or credits to Deposit Account No. 06-1050.

[1] The Federal Circuit, furthermore, has also found definite the term "substantially" even though it did not appear in the specification. *See Ecolab, Inc.*, 264 F.3d at 1367; *LNP Engineering Plastics, Inc.*, 275 F.3d at 1355.

Respectfully submitted,

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Appendix of Claims

48. An integrated semiconductor structure comprising:

a multijunction solar cell including a first photoactive junction formed in a substrate forming a bottom subcell where there are no subcells located between the bottom subcell and the lower surface of the substrate, and a second photoactive junction formed in a region overlying said bottom subcell and forming a second subcell; and

means for passing current when said multijunction solar cell is shaded, wherein said means is on the same substrate as the multijunction solar cell, wherein said means and said bottom subcell have an identical sequence of semiconductor layers, wherein each semiconductor layer in the means has substantially the same composition and thickness as the corresponding layer in the bottom subcell, wherein the means for passing current is electrically connected in parallel across the multijunction solar cell.

49. The structure as defined in claim 48, wherein said means for passing current is a bypass diode formed on the substrate.

50. The structure as defined in claim 49, wherein said bottom subcell and said bypass diode are formed in the same process.

51. The structure as defined in claim 49, wherein the bypass diode has a Schottky junction.

52. An integrated semiconductor structure comprising:

a multijunction solar cell including a bottom subcell formed on a substrate where there are no subcells between the bottom subcell and the lower surface of the substrate;

and

means for passing current when said multijunction solar cell is shaded, wherein said means is on the same substrate as the multijunction solar cell, wherein said means and said bottom subcell have an identical sequence of semiconductor layers, wherein each semiconductor layer in the means has substantially the same composition and thickness as the corresponding layer in the bottom subcell, and wherein the means for passing current is electrically connected in parallel across the multijunction solar cell.

53. The structure as defined in claim 52, wherein said bottom subcell is formed on a first portion of the substrate and said means for passing current is a bypass diode formed on a second portion of the substrate that is laterally spaced from said first portion.

54. The structure as defined in claim 53, wherein said bottom subcell and said bypass diode are formed in the same process.

55. The structure as defined in claim 53, wherein said bypass diode is electrically connected across the subcells of the multijunction solar cell to protect said subcells against reverse biasing.

56. The structure as defined in claim 53 wherein the bypass diode has a Schottky junction.

57. An integrated semiconductor structure comprising:

a multijunction solar cell including a first solar cell formed on a substrate; and

a bypass diode, on the same substrate as the solar cell, wherein the bypass diode is directly electrically connected to the base of said first solar cell and to a top cell of the multijunction solar cell for passing current when said multijunction solar cell is shaded, wherein said bypass diode and said first solar cell have an identical sequence of semiconductor layers, wherein each semiconductor layer in the bypass diode has substantially the same composition and thickness as the corresponding layer in the first solar cell; and further wherein

said first solar cell is the bottom solar cell where there are no solar cells between the first solar cell and the lower surface of the substrate.

58. The structure as defined in claim 57, wherein said first solar cell is formed on a first portion of the substrate and said bypass diode is formed on a second portion of the substrate spaced apart from said first portion.

59. The structure as defined in claim 57, further comprising a metal layer connecting said bypass diode to the base of the first solar cell.

60. An integrated semiconductor structure comprising:

a multijunction solar cell including first and second solar cells on a substrate;

means for passing current when said multijunction solar cell is shaded; and

a deposited metal layer connecting said multijunction solar cell and said means for passing current, said deposited metal layer contained within said semiconductor structure and entirely on a surface of said means for passing current, wherein

one end of said metal layer is coupled to the base of said first solar cell and another end of said metal layer is coupled to one terminal of said means for passing current; and further wherein

said means for passing current and said first solar cell have an identical sequence of semiconductor layers, wherein each semiconductor layer in the means for passing current has substantially the same composition and thickness as the corresponding layer in the first solar cell, and wherein the metal layer is disposed on sides of layers between the base of the first solar cell and the terminal in the means for passing current.

61. The structure as structure as defined in claim 60, wherein said first solar cell is formed on a first portion of the substrate, and said means for passing current is a bypass diode formed on a second portion of the substrate.

62. The structure as defined in claim 60, wherein said multijunction solar cell and said means for passing current are separated by a trough, and said metal layer lies over said trough.

63. The structure as defined in claim 60, wherein both said first solar cell and said bypass diode are formed in the same process.

64. The structure as defined in claim 62, wherein said means for passing current is electrically connected across at least said first and second cells to protect said first and second cells against reverse biasing.

65. A solar cell semiconductor device comprising:

an integral semiconductor body having a sequence of layers of semiconductor material including a first region in which the sequence of layers of semiconductor material forms the first cell of a multijunction solar cell; and

a second region laterally spaced apart from said first region and in which the sequence of layers corresponding to the sequence of layers forming said first cell forms a bypass diode to protect said multijunction solar cell against reverse biasing,

a metal layer entirely on a surface of the bypass diode and disposed in the space between the first and second region, wherein the metal layer electrically connects the bypass diode to the multijunction solar cell and electrically shorts a plurality of layers of the second region between the multijunction solar cell and the bypass diode, wherein

the sequence of semiconductor layers in the first region forming said first cell and the sequence of semiconductor layers in the second region forming said bypass diode are identical, wherein each semiconductor layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region.

66. A device as defined in claim 65, wherein the sequence of layers of said first cell and the sequence of layers of the bypass diode are formed in the same process step.

68. A solar cell semiconductor device comprising:

a substrate;

a sequence of layers of material deposited on said substrate, including a first region in which the sequence of layers of material forms at least one cell of a multijunction solar cell, and a second region in which the corresponding sequence of layers forms a bypass diode to protect said cell against reverse biasing, wherein the sequence of layers in the first region forming said at least one cell and the sequence of layers in the second region forming said bypass diode are identical, wherein each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region; and

a first discontinuous lateral semiconductor conduction layer directly on said substrate wherein the first discontinuous lateral semiconductor conduction layer includes a first portion in the bypass diode that is adapted to electrically contact a metal layer disposed on a side of the discontinuous lateral conduction layer and a second portion in the bypass diode that is laterally spaced away from the first portion and adapted to electrically contact an active region of said bypass diode.

69. A device as defined in claim 68, wherein said lateral conduction layer in the first region is physically separated from the lateral conduction layer in the second region.

70. A device as defined in claim 68, wherein said lateral conduction layer is a highly doped layer.

71. A device as defined in claim 70, wherein said lateral conduction layer is composed of GaAs.

72. A device as defined in claim 68, wherein one of the layers of said sequence of layers is an etch stop layer, and a second lateral conduction layer is disposed directly over said etch stop layer.

73. A device as defined in claim 68, wherein said substrate includes a photoactive junction.

74. A device as defined in claim 73, wherein said substrate is germanium.

75. A device as defined in claim 73, wherein said substrate forms an electrical connection path between said multijunction solar cell and said bypass diode.

76. A device as defined in claim 68

wherein the metal layer is disposed on a portion of said substrate and over at least a portion of said second region and functioning to (i) electrically short layers of said second region, and (ii) connect the substrate to a second lateral conduction layer to complete the electrical circuit between the multijunction solar cell and the bypass diode.

77. A solar cell semiconductor device comprising:

a substrate;

a sequence of layers of semiconductor material deposited on said substrate including a first region in which the sequence of layers of semiconductor material forms at least one cell of a multijunction solar cell, and a second region in which the corresponding sequence of layers forms a bypass diode to protect said at least one cell of a multijunction solar cell against reverse biasing, wherein the sequence of layers in the first region forming said at least one cell and the sequence of layers in the second region forming said bypass diode are identical, wherein each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region; and

a lateral conduction semiconductor layer deposited on said substrate including a first portion disposed in said first region, and a second portion disposed in said second region and physically separated from said first portion, wherein said second portion of said lateral conduction semiconductor layer includes a first region that directly and electrically contacts a first InGaP layer of said bypass diode and a second region laterally spaced apart from the first region that directly and electrically contacts a first metal layer.

78. A device as defined in claim 77, wherein said lateral conduction layer is a highly doped layer.

79. A device as defined in claim 77, wherein said lateral conduction layer is composed of GaAs.

80. A device as defined in claim 77, wherein one of the layers of said sequence of layers is an etch stop layer, and said lateral conduction layer is disposed directly over said etch stop layer.

82. A device as defined in claim 77, wherein said bypass diode further comprises a GaAs layer disposed over said first InGaP layer, and a second InGaP layer disposed over said GaAs layer.

83. A device as defined in claim 82, further comprising a second metal layer deposited over said second InGaP layer and forming a Schottky junction with said second InGaP layer.

84. A device as defined in claim 77, wherein said substrate includes a photoactive junction.

85. A device as defined in claim 77 wherein said substrate is germanium.

86. A device as defined in claim 77, wherein said substrate forms an electrical connection path between said multijunction solar cell and said bypass diode.

87. A device as defined in claim 86, wherein the first metal layer is disposed on a portion of said substrate and over at least a portion of said second region and functioning to connect the substrate to a portion of said lateral conduction layer for completing the electrical circuit between the multijunction solar cell and the bypass diode.

88. A solar cell semiconductor device comprising:

a substrate;

a sequence of layers of semiconductor material deposited on said substrate, including a first region in which the sequence of layers of semiconductor material forms at least one cell of a multijunction solar cell;

a second region in which the corresponding sequence of layers forms a bypass diode to protect said cell against reverse biasing, wherein the sequence of layers in the first region forming said at least one cell and the sequence of layers in the second region forming said, bypass diode are identical, wherein each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region; and

wherein said sequence of layers includes a highly conductive discontinuous lateral semiconductor conduction layer deposited on said substrate

and wherein the discontinuous lateral semiconductor conduction layer includes a first portion in the bypass diode for making direct electrical contact with a first active layer of said bypass diode and a second portion in the bypass diode laterally spaced away from the first portion and adapted to form a contact region beneath the active layer to allow said bypass diode to be electrically connected to said multijunction solar cell.

89. A device as defined in claim 88, further comprising a metal layer deposited on a portion of said substrate and over at least a portion of said second region and functioning to connect the

substrate to a portion of said lateral conduction layer for completing the electrical circuit between the multijunction solar cell and the bypass diode.

90. A device as defined in claim 88, wherein said lateral conduction layer includes a first portion disposed in said first region, and a second portion disposed in said second region and separated from the first portion.

91. A device as defined in claim 88, wherein said lateral conduction layer is a highly doped layer composed of GaAs.

92. A device as defined in claim 90, wherein said second portion of said lateral conduction layer makes electrical contact with the first active layer of said bypass diode.

93. A solar cell semiconductor device comprising:

a substrate;

a sequence of layers of semiconductor material deposited on said substrate, including a first region in which the sequence of layers of semiconductor material forms at least one cell of a multijunction solar cell;

a second region laterally spaced apart from said first region, wherein the sequence of layers in said second region and the sequence of layers in said first region are identical, wherein each layer in the first region has substantially the same composition and thickness as the corresponding layer in the second region; and

a metal layer deposited on a portion of said substrate and over at least a portion of said second region for electrically shorting semiconductor layers between the substrate and a lateral conduction semiconductor layer of said second region to enable a bypass diode to be formed in said second region, said metal layer contained within said solar cell semiconductor device.

94. A device as defined in claim 93,

wherein said metal layer connects said multijunction solar cell and said bypass diode with one end of said metal layer being coupled to the base of said one solar cell and another end of said metal layer is coupled to one terminal of said bypass diode.

95. A device as defined in claim 93, wherein said first portion and said second portion are separated by a trough, and said metal layer lies over at least a portion of said trough.

96. A device as defined in claim 93, wherein at least one layer of said first solar cell and said bypass diode are simultaneously formed in the same process.

97. A device as defined in claim 93, wherein said bypass diode is electrically connected by said metal layer across said solar cell to protect said solar cell against reverse biasing.

98. A device as defined in claim 93 the lateral conduction layer is on said substrate and electrically connects the multijunction solar cell to said bypass diode.

Evidence Appendix

In a previous reply (June 2006), Applicant submitted a Declaration by Paul R. Sharps under 37 C.F.R. §1.132. A copy of the Declaration is attached.

Related Proceedings Appendix

The present application is a continuation of U.S. Application No. 09/999,598.

An appeal to the Board of Appeals has been filed in connection with U.S. Application No. 10/773,343, which is a continuation of U.S. Application No. 10/280,593, which, in turn, is a continuation-in-part of U.S. Application No. 09/999,598.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 10/723,456	Confirmation No.: 5958
Applicants	: Paul R. Sharps, *et al.*	
Filed	: November 26, 2003	
TC/A.U.	: 1753	
Examiner	: Diamond, Alan D.	

DECLARATION UNDER 37 C.F.R. § 1.132

I, Paul R. Sharps, declare that:

1. I am a resident of Albuquerque, New Mexico, and am an inventor in the above identified patent application.

2. As the Examiner notes, and may be deduced from the Figures and the specification, the composition and thickness of the layers of the triple junction solar cell according to the present invention are intended to be uniform over the surface of the wafer. Thus, the layers of the bypass diode and the layers of the adjacent solar cell are intended to have "the same" composition and thickness.

3. However, as is known to those skilled in the art, the actual deposition of III-V compound semiconductor layers over the surface of a substrate is a complex chemical process, and the "ideal" uniformity of a resulting wafer with precisely "the same" or identical composition and thickness of the layers at every point on the surface is a practical impossibility.

4. Although one may colloquially or loosely refer to the layers as having "the same" composition and thickness, in reality, the nature of the deposition process inherently results in small variations both in composition and in thickness of each layer over the surface of the wafer.

5. It is my experience that variations of two to three percent in composition and in thickness of a compound semiconductor layer over the surface of the wafer are quite normal and in fact are well within manufacturing specifications for actual commercial products.

6. Since the citation by the Examiner of the JP '397 reference has made it necessary to expressly refer to the composition and thickness of the layers in both the solar cell portion and the bypass diode portion of the semiconductor structure of the present invention, consideration must be given as to the most appropriate manner of expressing the fact that the layers are intended ideally to be "the same," unlike those in the JP '397 reference, while still describing and covering the actual processed compound semiconductor structures on wafers of the present invention. As noted above, neither the composition nor the thickness of deposited compound semiconductor layers are exactly "the same" or identical over the entire surface of the wafer.

7. The Remarks to the Amendment submitted by Applicant on November 7, 2005 noted that in the application as filed, figures 3-5 and the text describing those figures (from page 5, line 27 to page 8, line 4) describes how the bypass diode is constructed by etching a sequence

of epitaxially deposited layers forming a single or "integral" semiconductor structure so that the remaining layers after etching in one region form a bypass diode, and the remaining layers in the other region after etching form a multijunction solar cell, both regions being in a single semiconductor structure. Therefore, inherent as a result of the manufacturing process is the fact that the layers of the bypass diode have substantially the same composition and thickness because the bypass device and the subcell were formed from the same layers before etching, and the thickness of the remaining layers is not changed by the etching.

8. Therefore, out of an abundance of caution and in the interest of technical accuracy, rather than using the absolute expression "the same" in the claims, the undersigned submits that the phrase "substantially the same" is more accurate and is supported by the specification as would be understood by those skilled in the art reading a description of the fabrication process described from page 5, line 27 through page 8, line 4 of the application as filed.

9. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believe to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Signed in Albuquerque, New Mexico this 17th day of May 2006.

Paul R. Sharps

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